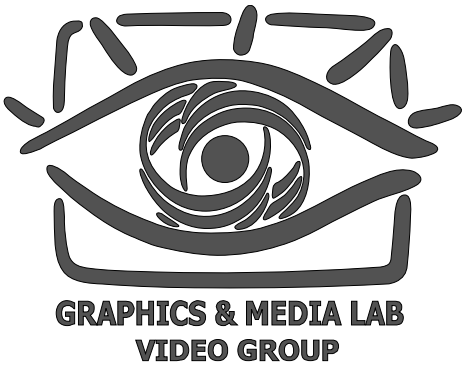


MPEG-2 Video Decoders Comparison

Project head: Dr. Dmitriy Vatolin,
Dr. Maxim Smirnov
Measurements, analysis: Dmitriy Kulikov
Translation: Dr. Maxim Smirnov
Verification: Alexander Parshin

Decoders:

- bitcontrol MPEG-2 Video Decoder
- DScaler MPEG2 Video Decoder
- Elecard MPEG-2 Video Decoder
- ffdshow MPEG-4 Video Decoder (libavcodec)
- InterVideo Video Decoder
- Ligos MPEG Video Decoder
- MainConcept MPEG Video Decoder
- Pinnacle MPEG-2 Decoder

May 2006

CS MSU Graphics&Media Lab

Video Group

http://www.compression.ru/video/

videocodec-testing@graphics.cs.msu.ru

Contents

Thanks

The authors would like to express their gratitude to Intel and Elecard companies for the software provided for this comparison.

Overview

Decoders

Name	Developer	Version
1. bitcontrol MPEG-2 Video Decoder	BitCtrl Systems GmbH	1.5.0.251
2. DScaler MPEG2 Video Decoder	http://deinterlace.sourceforge.net/	DScaler5
3. Elecard MPEG-2 Video Decoder	Elecard Ltd.	1.0.197
4. ffdshow MPEG-4 Video Decoder	http://sourceforge.net/projects/ffdshow	dev. version for Oct 12 2004
5. InterVideo Video Decoder	InterVideo, Inc.	WinDVD v.7.0.27.66
6. Ligos MPEG Video Decoder	Ligos Corporation	4.0.0.77
7. MainConcept MPEG Video Decoder	MainConcept AG	1.00.00.76
8. Pinnacle MPEG-2 Decoder	Pinnacle Systems, Inc.	Pinnacle Studio 10.2

Sequences

Sequence	Number of frames	Frames per second	Resolution and color space
1. foreman	300	30	352x288 (YV12)
2. battle	500	24	704x288 (YV12)
3. battle[1]	1599	24	704x288 (YV12)

[1] This sequence is used in encoder testing (see Appendix A.)

Tasks and Test Rules

MPEG-2 Video Codecs Comparison Objectives

The main task was to comparatively evaluate quality of MPEG-2 decoders while decoding distorted streams. This question is topical for satellite broadcasting and, to a lesser degree, for DVD video playback.

Test Rules

- A sequence was encoded in MPEG-2 Elementary Stream with constant 3 Mb/s bitrate using TMPGEnc; all other options were by default.
- By means of Elecard XMuxer Pro the obtained stream was transformed to the MPEG-2 Transport Stream.
- The data were randomly distorted using a specially written utility. The probability of introducing bit error was regulated. The first header of the stream was kept intact in all cases.
- The distorted data were decoded using different decoders and the obtained sequences were compared with the undistorted decoded sequences using objective metrics.
- The process of introducing errors, decoding and metrics calculation was repeated 100 times to achieve more adequate results. This was reasoned by the fact that opportunity of effective error correction or error effects mitigation depends in many respects on the error position in a stream.
- If some decoder failed to decode a frame, the gray frame was inserted in the output stream. For the sake of per-frame comparison the Y-PSNR values for such frames were set to 0.
- The metrics values were averaged.
- The following software products and modules were used for DirectShow codecs testing:
    - GraphEdit version 1.33133;
    - AviSynth version 2.55;
    - VirtualDub version 1.6.14;
    - TMPGEnc version 2.5;
    - Elecard Xmuxer pro version 1.1;
    - Elecard MPEG-2 Demultiplexer[2] version 2.0b and 1.0.47.
- The open library randoma.lib from the Pseudo random number generators[3] suite was used to create error generation utility.
- A special version of MSU Video Quality Measure[4] program was used to calculate all metrics.

[2] During the preliminary tests we have used trial-version of Elecard Demultiplexer and because of its good quality we have asked and received a full version from Elecard Ltd.
[3] http://www.agner.org/random
[4] http://www.compression.ru/video/quality_measure/video_measurement_tool_en.html

- Two computers with the following configuration were used for testing:
  - Processor: Pentium 4, 2.8 GHz with Hyper Threading.
  - Operating system: Windows 2000 Pro, SP4.
  - Memory: 1 GB.
  - Video Accelerator: ATI Radeon 9600 Series.
  - Hard drive: 2x80 GB ATA100.

Sequences

Foreman

Sequence title	foreman
Resolution	352x288
Number of frames	300
Color space	YV12
Frames per second	30
Source	Uncompressed (standard sequence), progressive

Picture 1. Frame 77

Picture 2. Frame 258

Standard sequence. A face with a very rich mimic is in picture. On the one hand, motion is not very intensive here; on the other hand, it is disordered, not straightforward. Intricate character of motion creates noticeable problems for the motion compensation process. In addition camera is shaking that makes the image constantly unsteady. In the end of the sequence camera suddenly turns to the building site and then an almost motionless scene follows. So this sequence can be used to study codec's behavior on a static scene after intensive motion.

Battle

Sequence title	battle
Resolution	704x288
Number of frames	1599, 500
Color space	YV12
Frames per second	24
Source	MPEG-2 (DVD), FlaskMPEG deinterlace

Picture 3. Frame 839

This sequence is a fragment of the “Terminator-2” movie, which represents its very beginning. This sequence is very hard to compress. That is because of constant brightness changes due to explosions and laser flashes (see the picture above), very quick motion and frequent changes of the scene.

Two “battle” sequences with different number of frames were used during the testing:

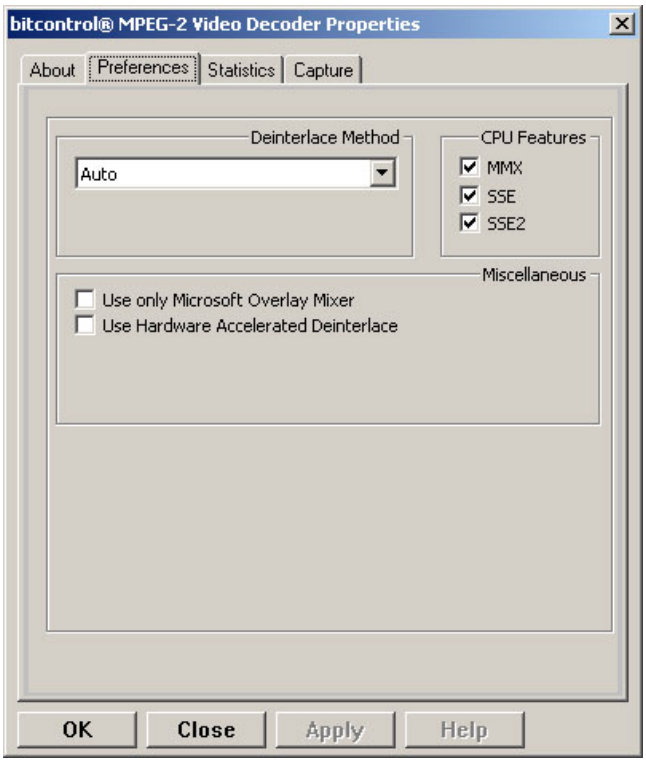
- 500 frames – for decoders testing;
- 1599 frames – for encoders testing.

Decoders

Decoders

BitControl

- DirectShow decoder
- Version 1.5.0.251
- Small number of tuning parameters, mainly deinterlacing controls
- Increases brightness of output sequence

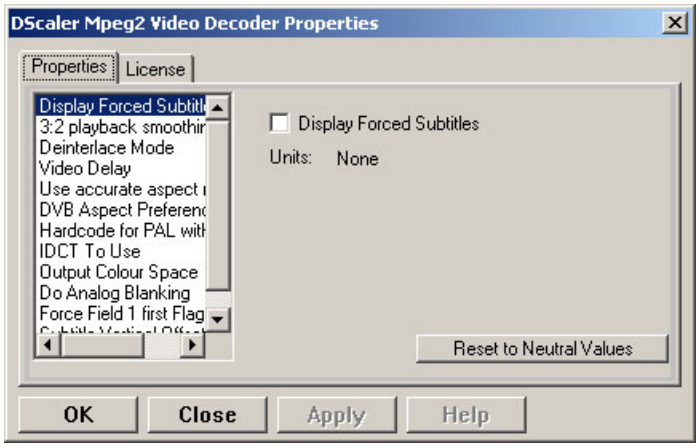


Picture 4. bitcontrol MPEG-2 Video Decoder

Note: The decoder increases brightness. That was taken into account while calculating metrics.

DScaler

- DirectShow decoder
- Version DScaler5
- Big number of tuning parameters

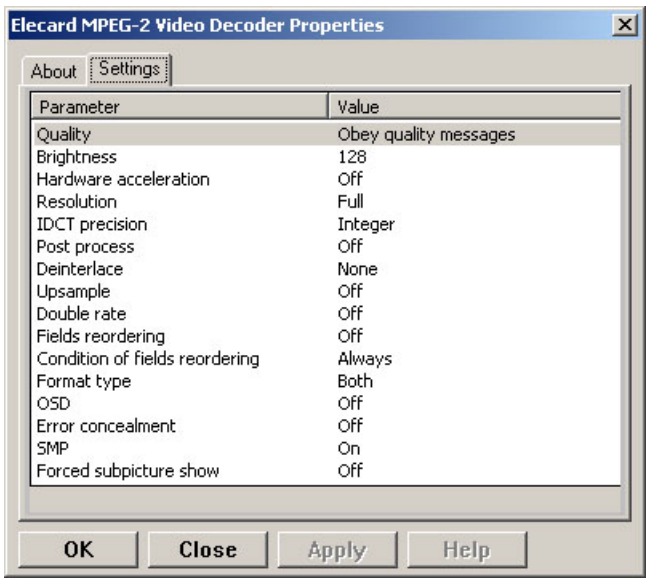


Picture 5. DScaler MPEG2 Video Decoder

Note: The decoder performed all tasks without any problems.

Elecard

- DirectShow decoder
- Version 1.0.197
- A lot of tuning parameters, including parameters for distorted video stream processing

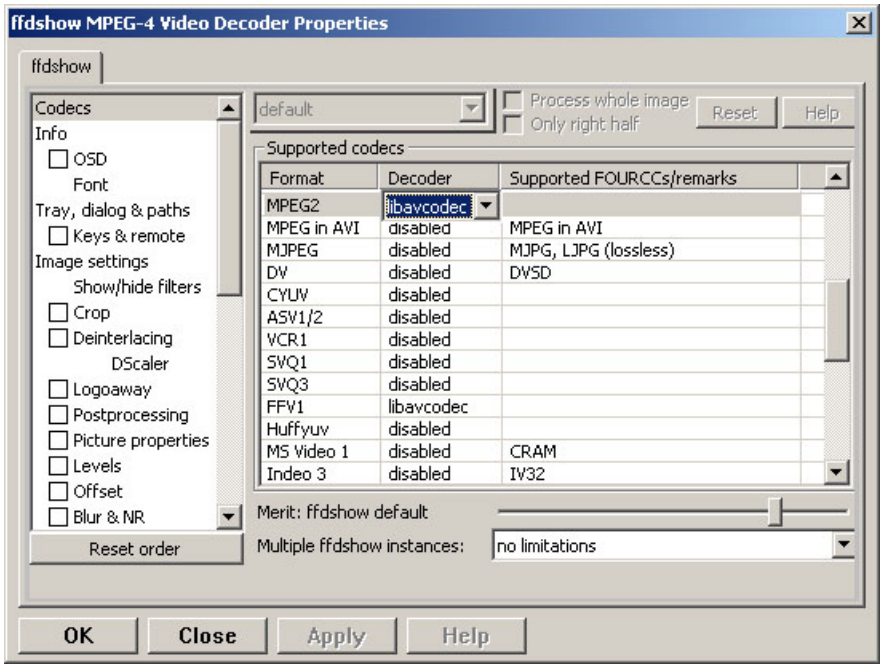


Picture 6. Elecard MPEG-2 Video Decoder

Note: The decoder performed all tasks without any problems.

FFDShow

- DirectShow decoder
- Version Oct 12 2004
- Ample quantity of tuning parameters, pre-processing and post-processing controls
- Two different MPEG-2 decoders:
  - libavcodec;
  - libmpeg2.

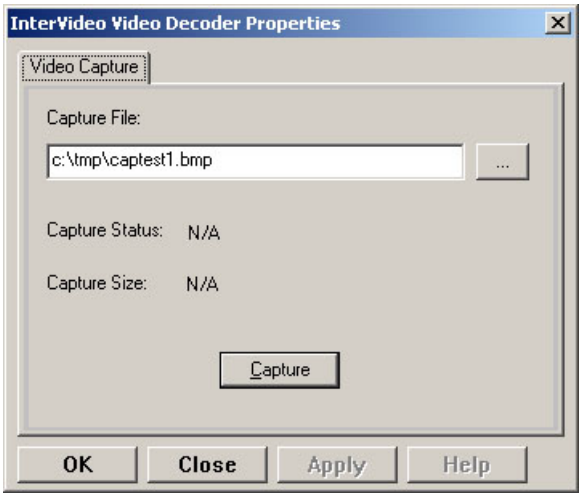


Picture 7. ffdshow MPEG-4 Video Decoder

Note: At first two different MPEG-2 decoders were tested, but since libavcodec showed considerably better quality than libmpeg2, only libavcodec decoder was used in the subsequent studies.

InterVideo

- DirectShow decoder
- Version Oct 12 2004
- No tuning parameters

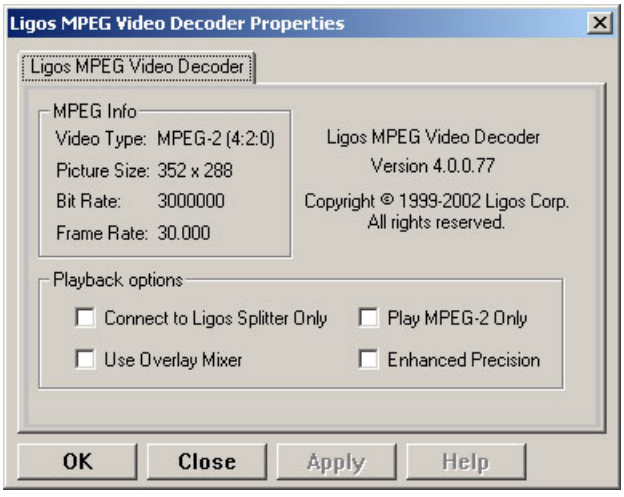


Picture 8. InterVideo Video Decoder

Note: The decoder performed the tasks without problems except for failing to decode a distorted stream.

Ligos

- DirectShow decoder
- Version 4.0.0.77
- Few tuning parameters

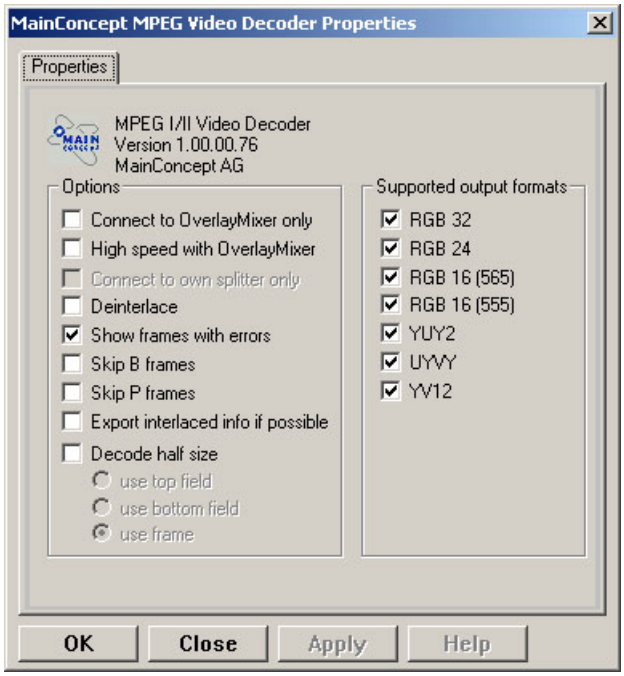


Picture 9. Ligos MPEG Video Decoder

Note: This decoder incorrectly works with Elecard MPEG2 Demultiplexer (2.0b), so, for this decoder, Elecard MPEG Demultiplexer (1.0.47) was used instead.

MainConcept

- DirectShow decoder
- Version 1.00.00.76
- Big number of tuning parameters, including parameters for distorted streams processing

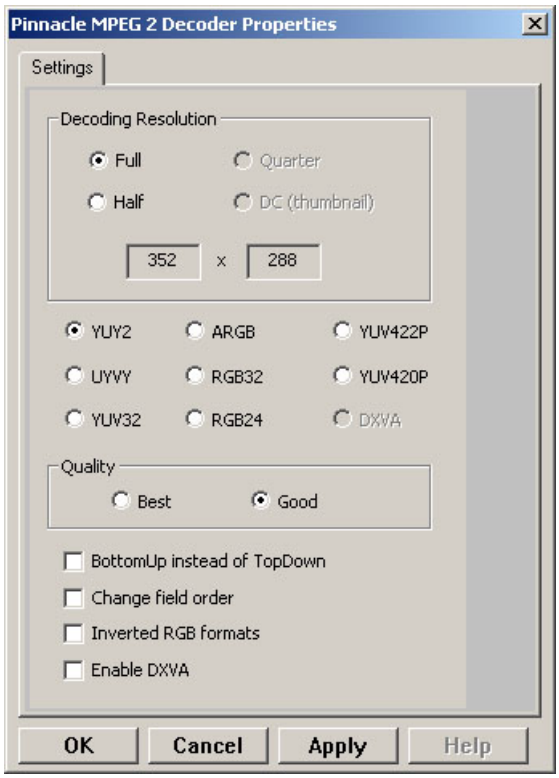


Picture 10. MainConcept MPEG Video Decoder

Note: The decoder performed all tasks without any problems.

Pinnacle

- DirectShow decoder
- Version Pinnacle Studio 10.2
- Big number of tuning parameters

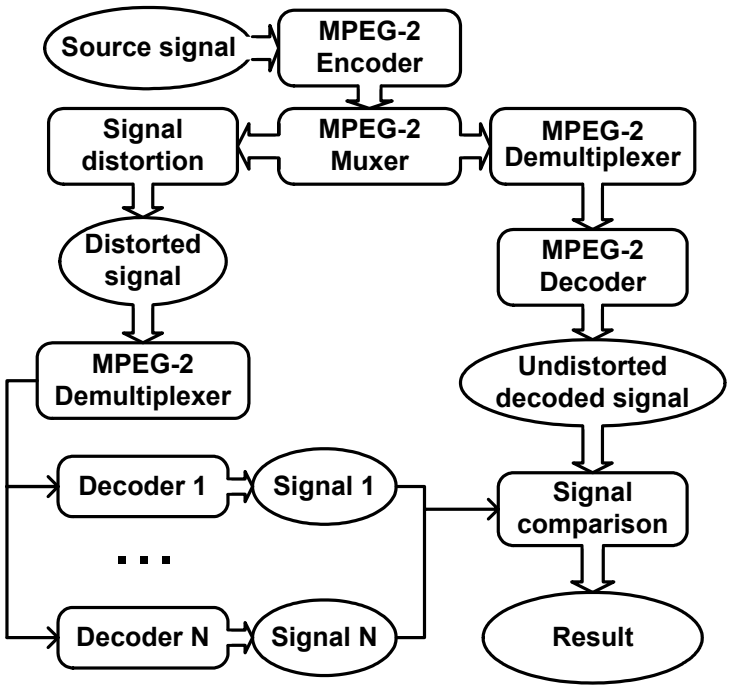


Picture 11. Pinnacle MPEG-2 Decoder

Note: The decoder performed all tasks without any problems.

Results

The main principle of this part of the testing: different decoders process the same distorted stream.



Picture 12. Scheme of conducting decoders testing

Elecard MPEG-2 Decoder was used as a MPEG-2 decoder for uncorrupted video stream. It is explained by the fact that almost all decoders except Bitcontrol decode uncorrupted stream almost identically – the Y-PSNR value ranging from 60 to 100 dB in average in all cases. That means they are visually almost identical. For Bitcontrol the same decoder was used while doing signal comparison.

The testing was performed on two video sequences:

- Foreman;
- Battle.

For the Foreman sequence the encoded stream underwent distortions with bit inversion probabilities 10^{-4}, 10^{-5}, 10^{-6}. These probabilities were chosen as the typical error probabilities for satellite broadcasting using non-reliable channels.

For the Foreman sequence the encoded stream underwent distortions with bit inversion probability 10^{-5}.

For quality measurement the PSNR metric was used.

PSNR (peak-to-peak signal-to-noise ratio) – is a classic metric to assess quality of compressed video. For two images x and y metric value is calculated by the following formula:

$$d(X,Y) = 10 \cdot \log_{10} \frac{255^2 \cdot n^2}{\sum_{i=1,j=1}^{n,n} (x_{ij} - y_{ij})^2}$$

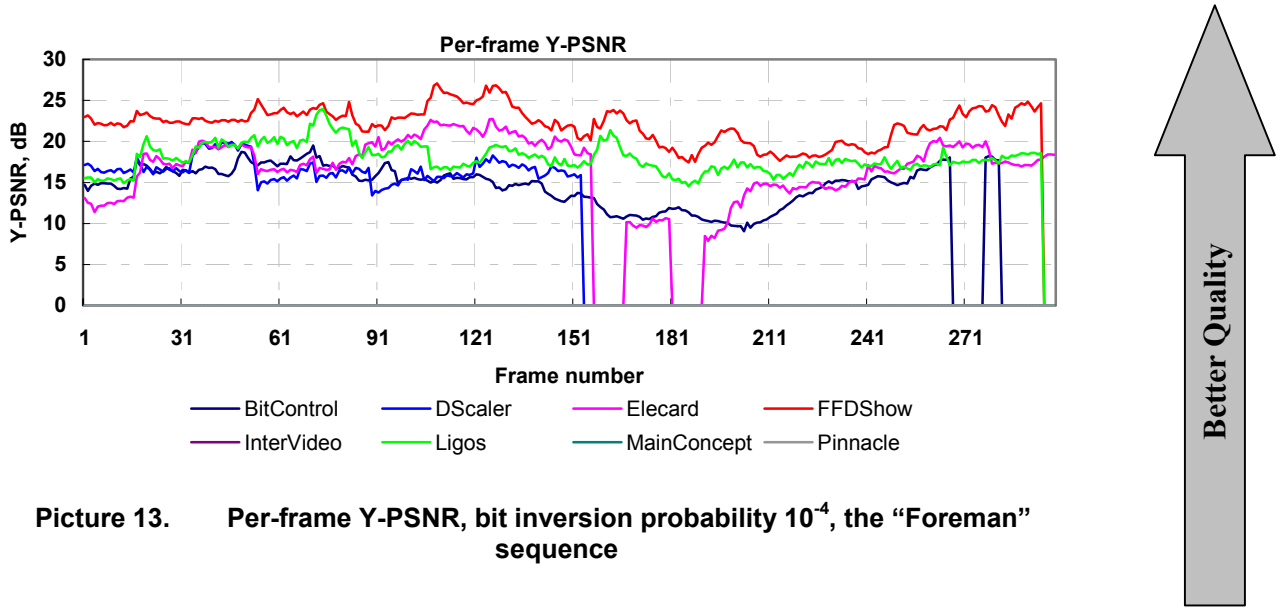
In spite of this metric does not generally conform to human perception of image distortion, it is a common medium to estimate video codecs quality for the last decades.

"Foreman" Sequence

Per-frame Metric Values

Since 100 executions and calculations were conducted for each error probability for all decoders, then it seems impossible and unreasonable to show all graphs. In this paper only one per-frame Y-PSNR graph for each of three error probabilities is presented.

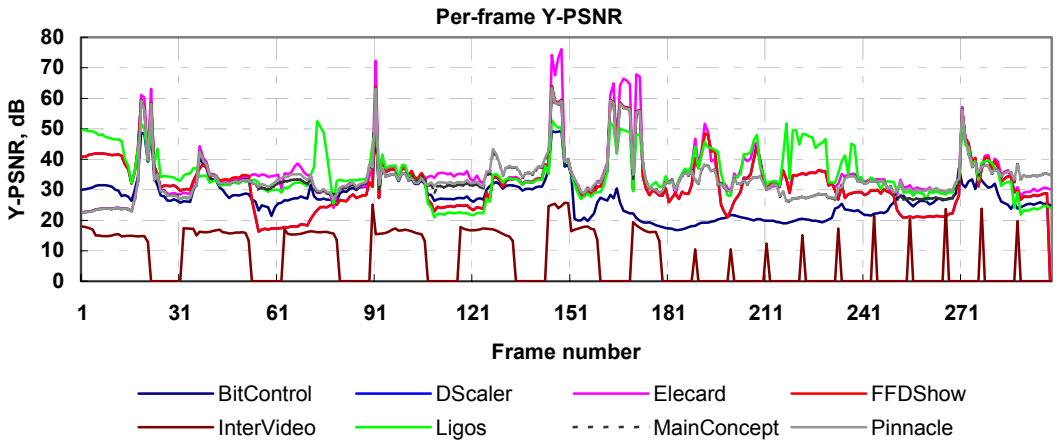
If some decoder failed to decode a frame, then a gray frame was written to the stream; metrics value for such frames is low. To clearly visualize per-frame metrics for the skipped frames a zero value of metric was used for them.



Picture 13. Per-frame Y-PSNR, bit inversion probability 10^{-4}, the "Foreman" sequence

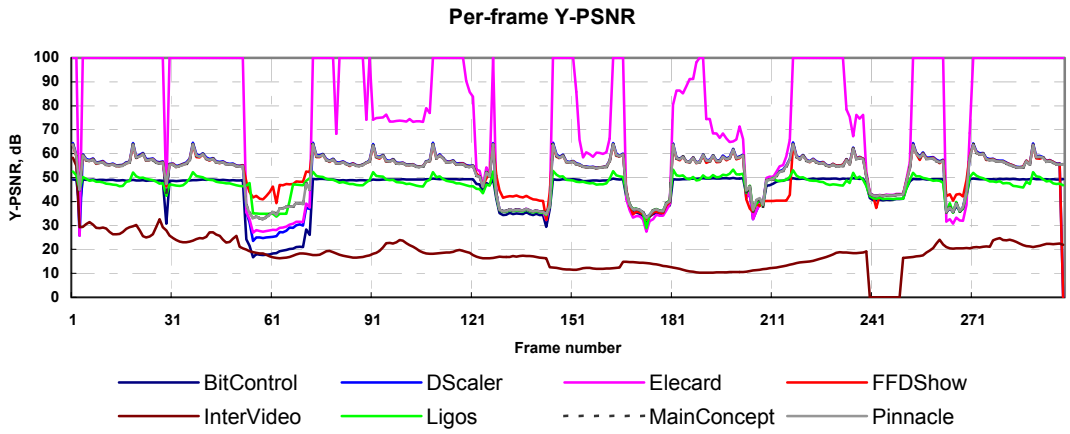
There are no InterVideo, Pinnacle and MainConcept decoders on this graph due to these decoders failed to decompress stream with error probability 10^{-4}.

The InterVideo decoder skipped all frames, MainConcept and Pinnacle decoders failed to open such a stream.



Picture 14. Per-frame Y-PSNR, bit inversion probability 10^{-5}, the "Foreman" sequence

The periodicity in Y-PSNR values for the InterVideo decoder is explained by the fact that this decoder works generally poor with distorted stream. For the data presented on the Picture 14, the result of this codec is as follows: a portion of frames was not decoded – "gray" frames (metric value is zero), and another portion represents recurring fragments, consisting of the same frames.

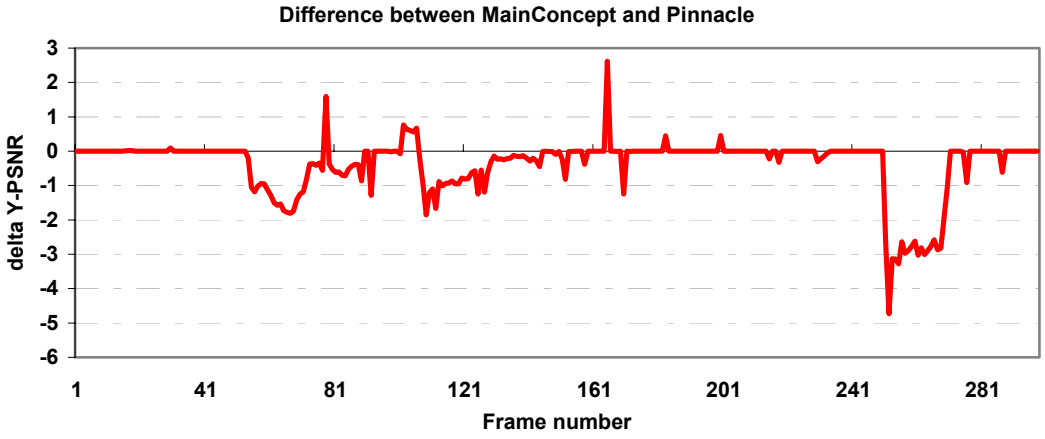


Picture 15. Per-frame Y-PSNR, bit inversion probability 10^{-6}, the "Foreman" sequence

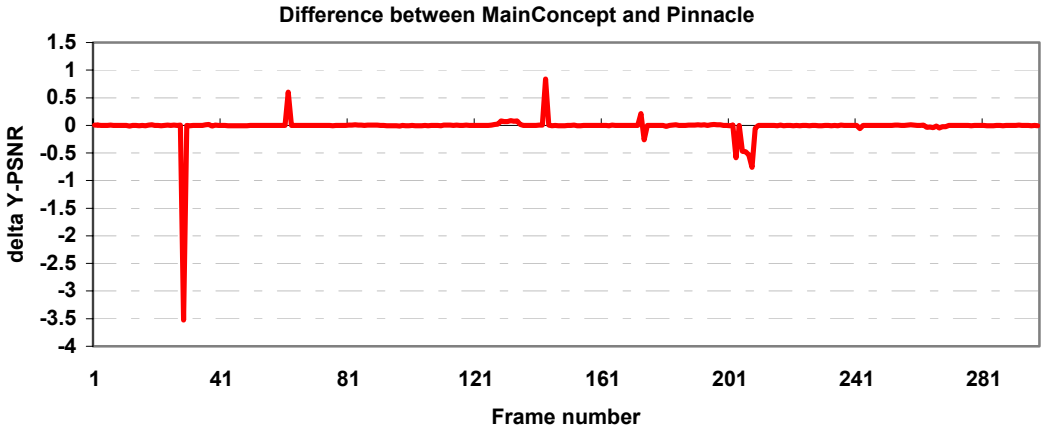
Doing analysis of the Picture 15, one should realize that PSNR metric values equaling 100 dB signify total identity of two frames, while values bigger than 50 dB mean that the frames visually identical, although having some insignificant differences.

The decoder from Elecard was used as a reference MPEG-2 decoder (that decodes the uncorrupted stream) and because of it Elecard decoder sometimes gains 100db while other decoders gain only 50-60 dB as maximum.

In the course of the performed study it was noted that MainConcept and Pinnacle decoders present very similar results, therefore an additional analysis was preformed with the results showed on the graphs below.



Picture 16. Per-frame Y-PSNR values difference, bit inversion probability 10^{-5}, the "Foreman" sequence



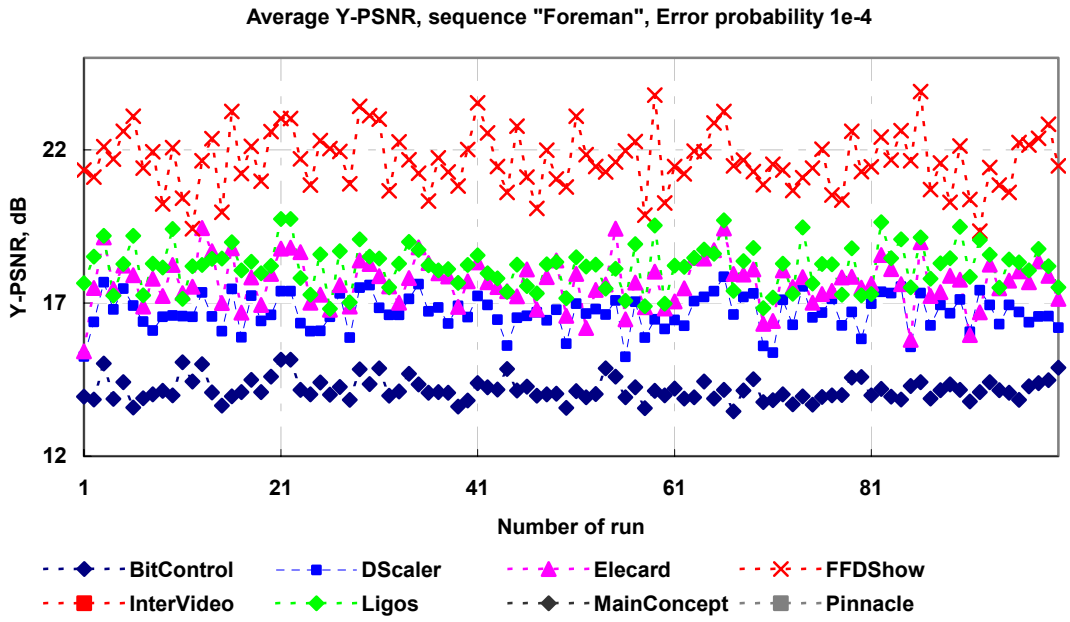
Picture 17. Per-frame Y-PSNR values difference, bit inversion probability 10^{-6}, the "Foreman" sequence

It is simple to notice that metric values for these two decoders differs only for few frames, giving ground to conclusion about common source codes of these decoders.

Per-frame metric values are insufficient for an integral analysis, that is why average metric values were also used in this work.

Average Metric Values

For the analysis of decoders' behavior and variation of metrics values for each execution (run) the following graphs can be used.

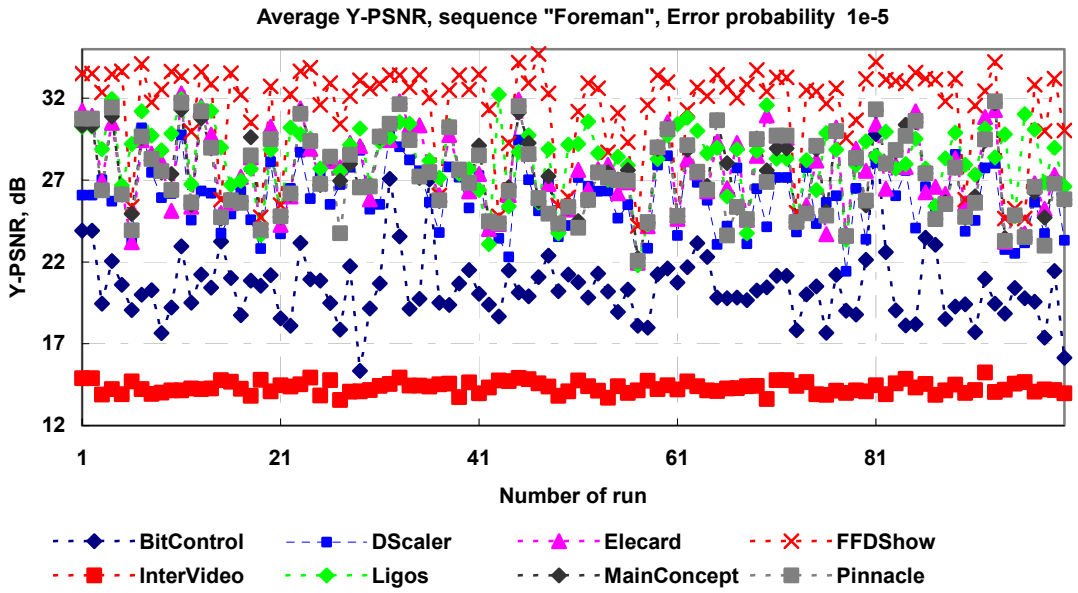


Picture 18. Average Y-PSNR values for each run, bit inversion probability 10^{-4}, the "Foreman" sequence

There are no InterVideo, Pinnacle and MainConcept decoders on this graph due to these decoders failed to decompress stream with error probability 10^{-4}.

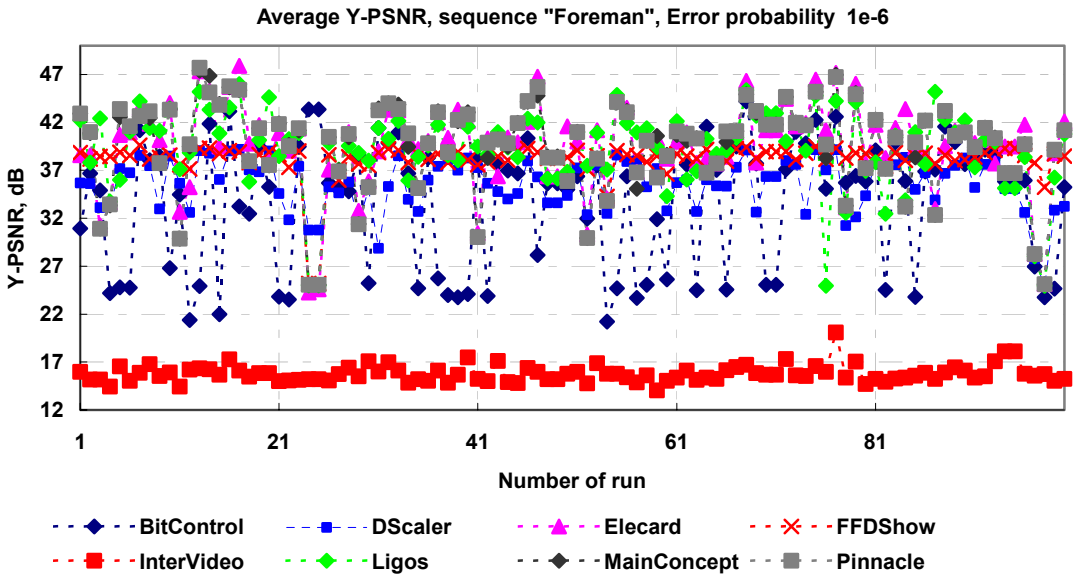
The InterVideo decoder skipped all frames, MainConcept and Pinnacle decoders failed to open such a stream.

For 10^{-4} error probability the decoders clustering in groups is rather noticeable.



Picture 19. Average Y-PSNR values for each run, bit inversion probability 10^{-5}, the "Foreman" sequence

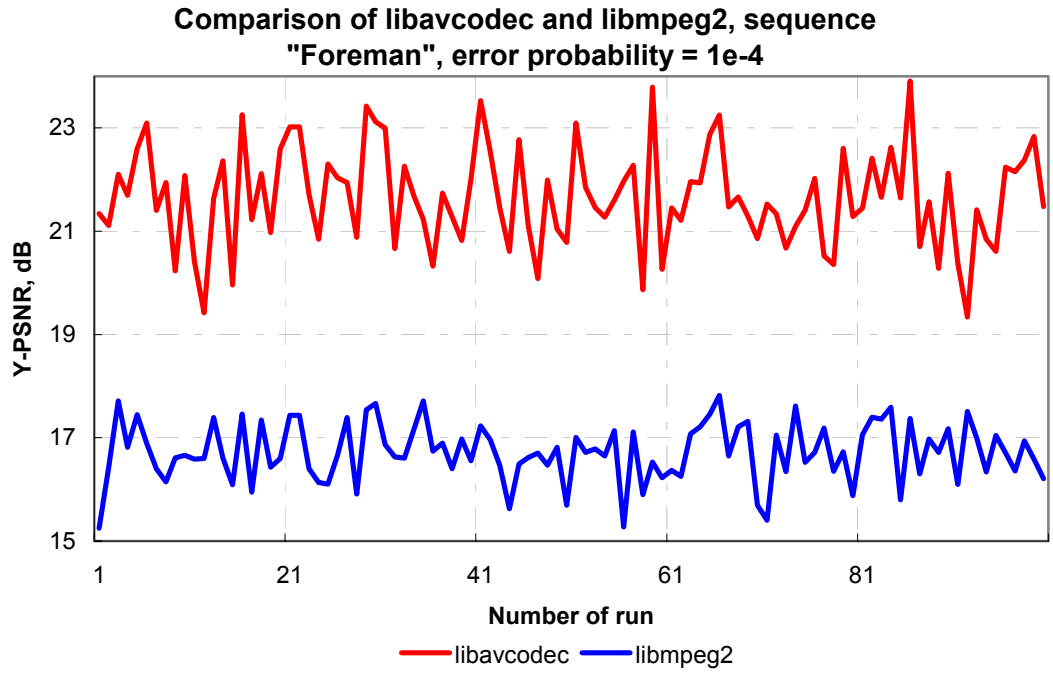
Decoders' grouping according to video quality is not so distinct when error probability equals to 10^{-5}.



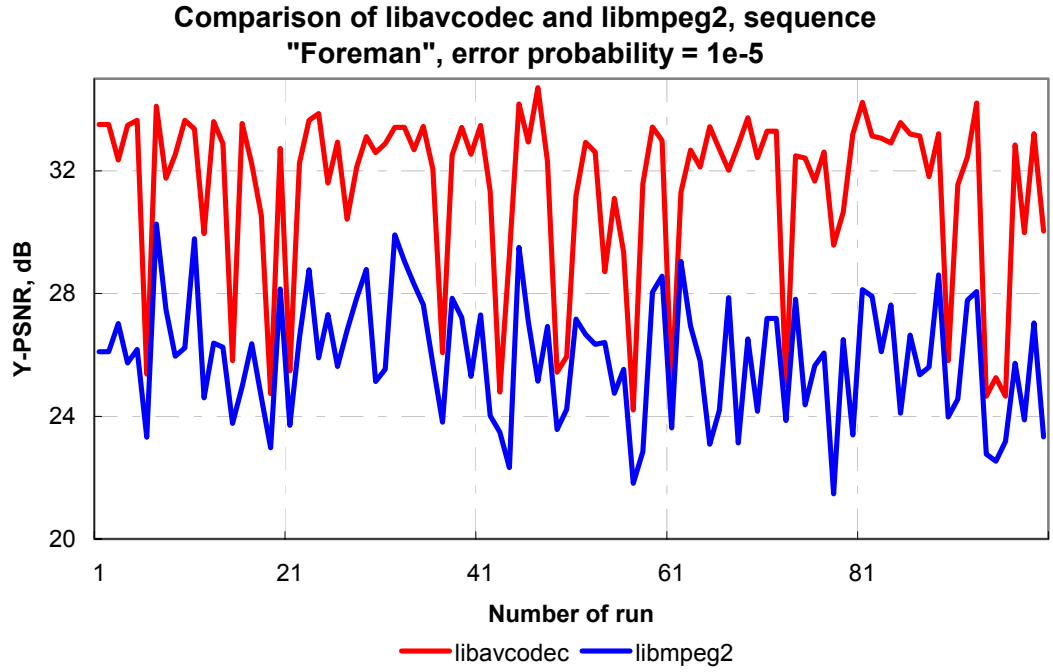
Picture 20. Average Y-PSNR values for each run, bit inversion probability 10^{-6}, the "Foreman" sequence

Under conditions of error probability 10^{-6} most of the decoders process stream in a similar to each other way, and the difference is less noticeable, than for the higher error probabilities.

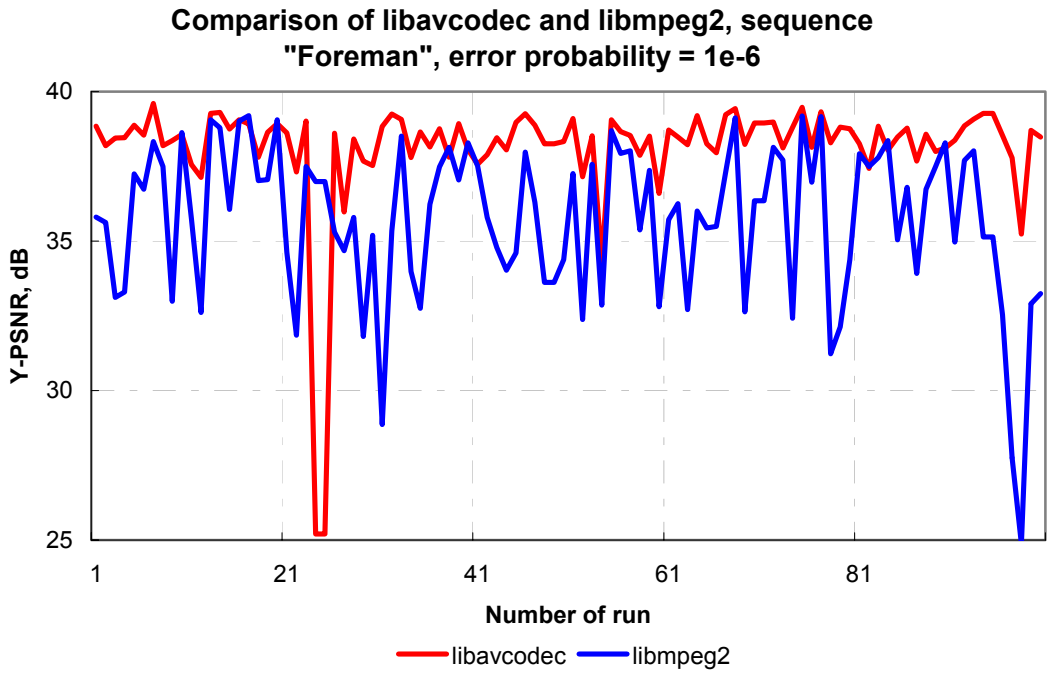
Since ffdshow has two different MPEG-2 decoders, at the beginning of the research it was studied which of those decoders operates better with erroneous streams.



Picture 21. Comparative assessment of ffdshow decoders, bit inversion probability 10^{-4}, the “Foreman” sequence. Average Y-PSNR



Picture 22. Comparative assessment of ffdshow decoders, bit inversion probability 10^{-5}, the “Foreman” sequence. Average Y-PSNR

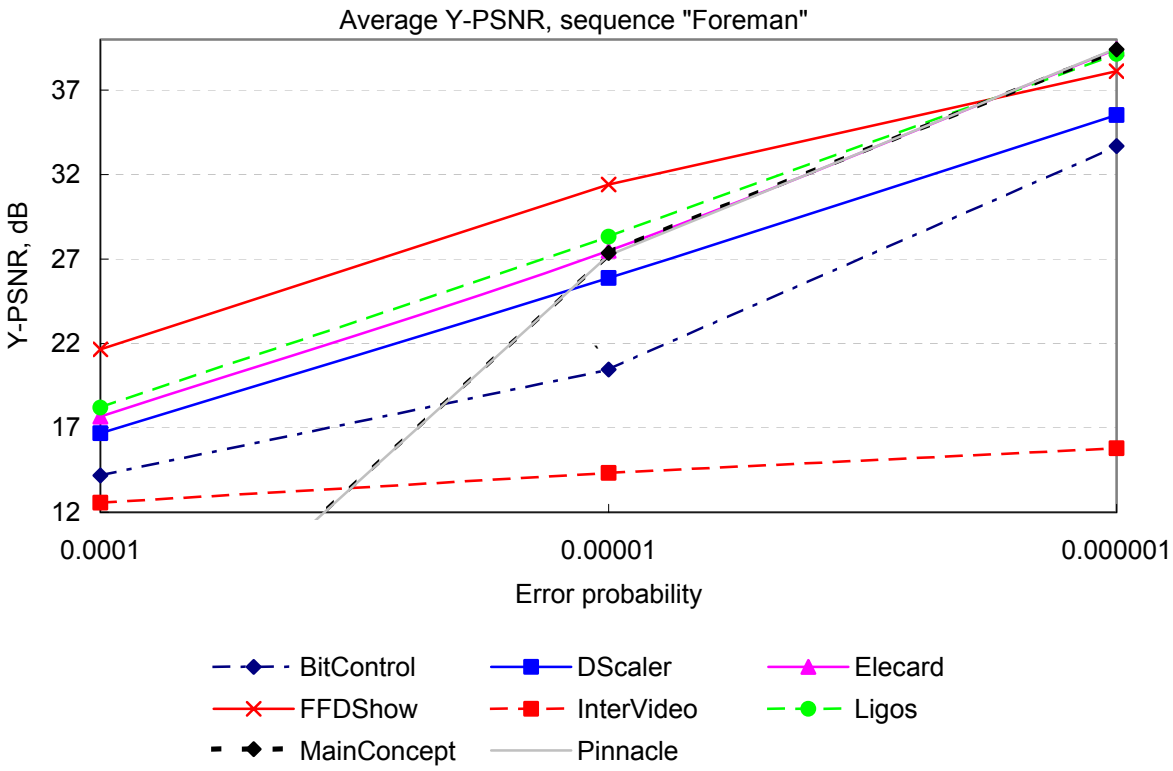


Picture 23. Comparative assessment of ffdshow decoders, bit inversion probability 10^{-6}, the "Foreman" sequence

It was decided after scrutiny of graphs on the Picture 21, Picture 22, Picture 23 to keep only libavcodec decoder for the experiments, as giving the higher quality of decoded streams.

Integrated Metric Values

Average per-frame values, calculated for 100 runs, were averaged on the whole for each video sequence. The result for the "Foreman" is presented on the following graph.



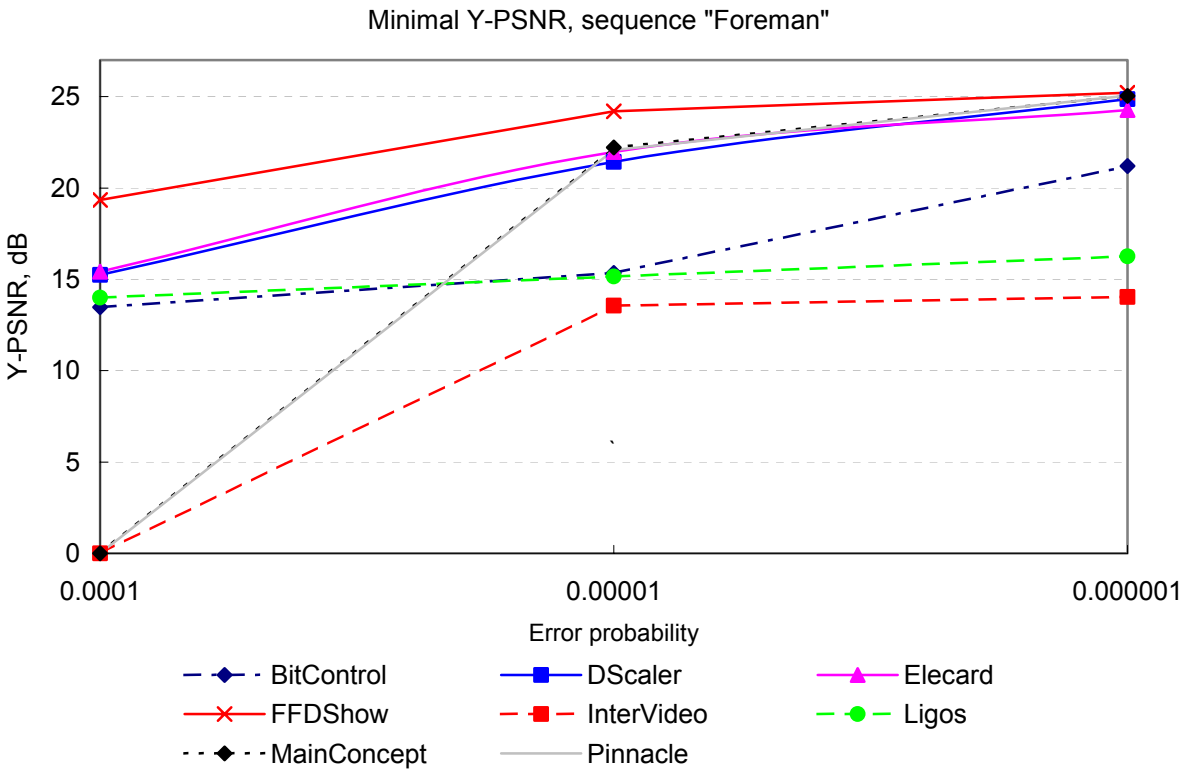
Picture 24. Average Y-PSNR values, the "Foreman" sequence

According to the graph on Picture 24 decoders can be can be ranked as follows:

1. FFDshow
2. Ligos
3. Elecard
4. MainConcept and Pinncale
5. DScaler
6. BitControl
7. InterVideo

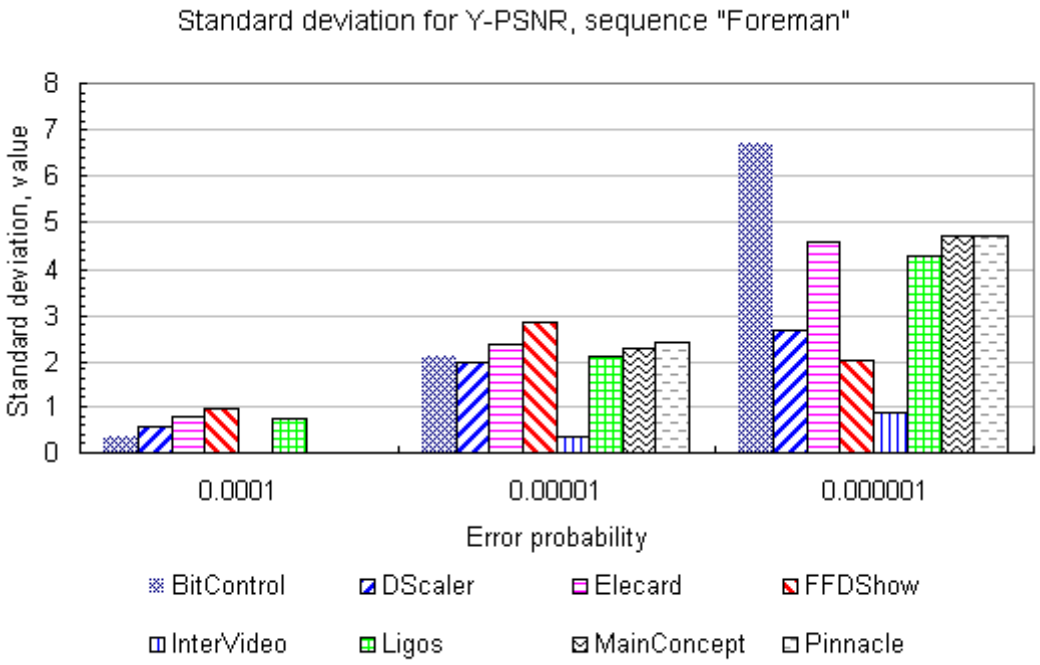
Average Minimal Values of the Metric

Besides average quality, it is important to know minimal guaranteed quality of video sequences after decoding of distorted streams. The average minimal values for 100 runs were found to estimate that. The result for the "Foreman" is presented on the following graph.



Picture 25. Minimal Y-PSNR values, the "Foreman" sequence

Standard deviation was used to evaluate statistical reliability of the obtained data.



Picture 26. Y-PSNR standard deviation, the "Foreman" sequence

Conclusions

All tested decoders can be divided in three different classes:

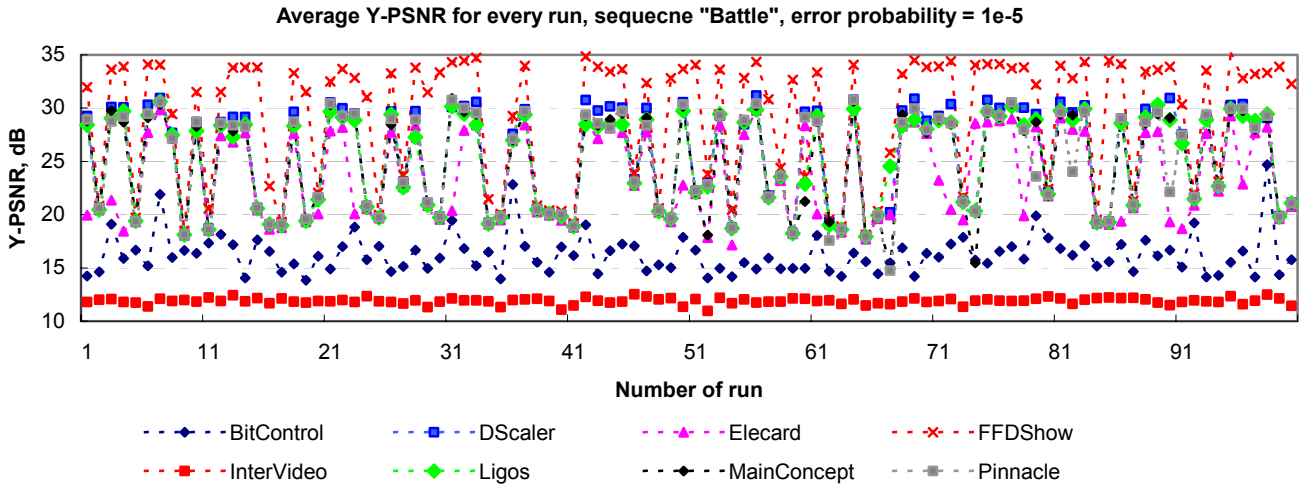
1) FFDShow, Elecard, Dscaler, BitControl, Ligos;
2) Pinnacle, MainConcept;
3) InterVideo.

The first class is the decoders with high-quality processing of erroneous stream. At that, the errors can have any probability. The quality is greatly increasing with decreasing of the probability. The second class contains decoders which fail to decode a stream with a big number of errors, but decode a moderately distorted stream providing good quality. The third class includes decoders which decode an erroneous stream comparatively bad without regard to errors rate and, on the whole, are not designed for working with such streams.

"Battle" Sequence

Decoders testing was performed on a modified "battle" sequence – the first 500 of 1599 frames were taken. It was done so to diminish total testing time.

Average Metric Values for All Runs

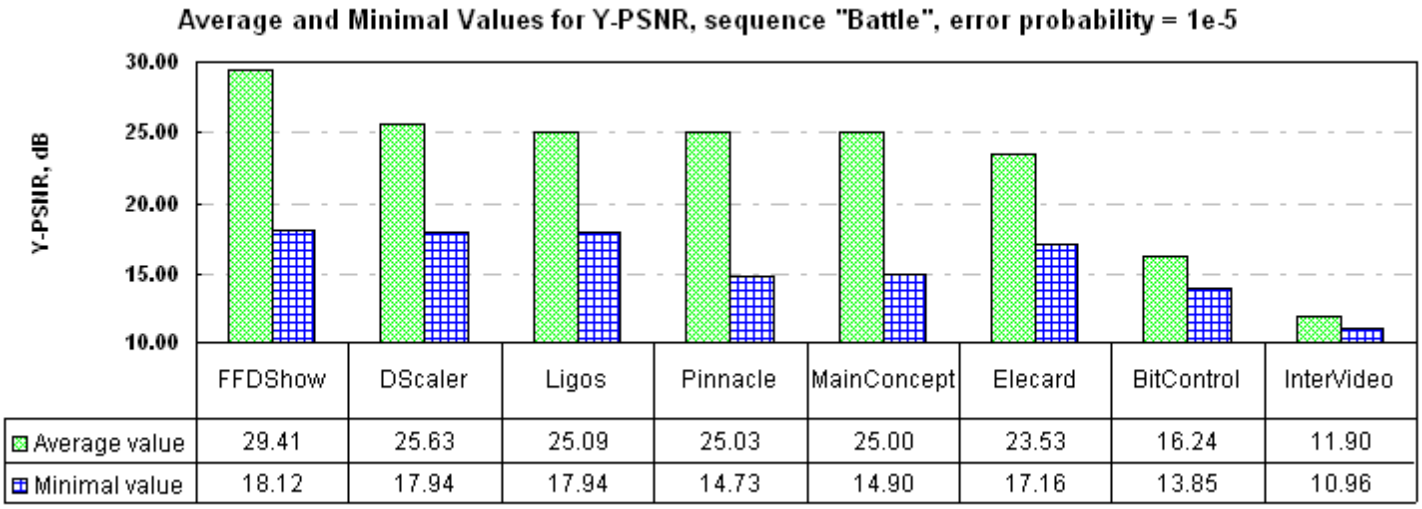


Picture 27. Average Y-PSNR values, the "battle" sequence, error probability 10^{-5}

The following conclusion can be made for this graph:

- The decoder from ffdshow often gives higher quality, than other decoders.
- Elecard, Ligos, DScaler, Pinnacle and MainConcept decoders provide approximately the same quality.
- BitControl decoder is characterized by low quality.
- InterVideo decoder failed to decode damaged stream.

Average and Minimal Metric Values



	FFDShow	DScaler	Ligos	Pinnacle	MainConcept	Elecard	BitControl	InterVideo
Average value	29.41	25.63	25.09	25.03	25.00	23.53	16.24	11.90
Minimal value	18.12	17.94	17.94	14.73	14.90	17.16	13.85	10.96

Picture 28. Average and minimal Y-PSNR values, the "battle" sequence, error probability 10^{-5}

Conclusions:

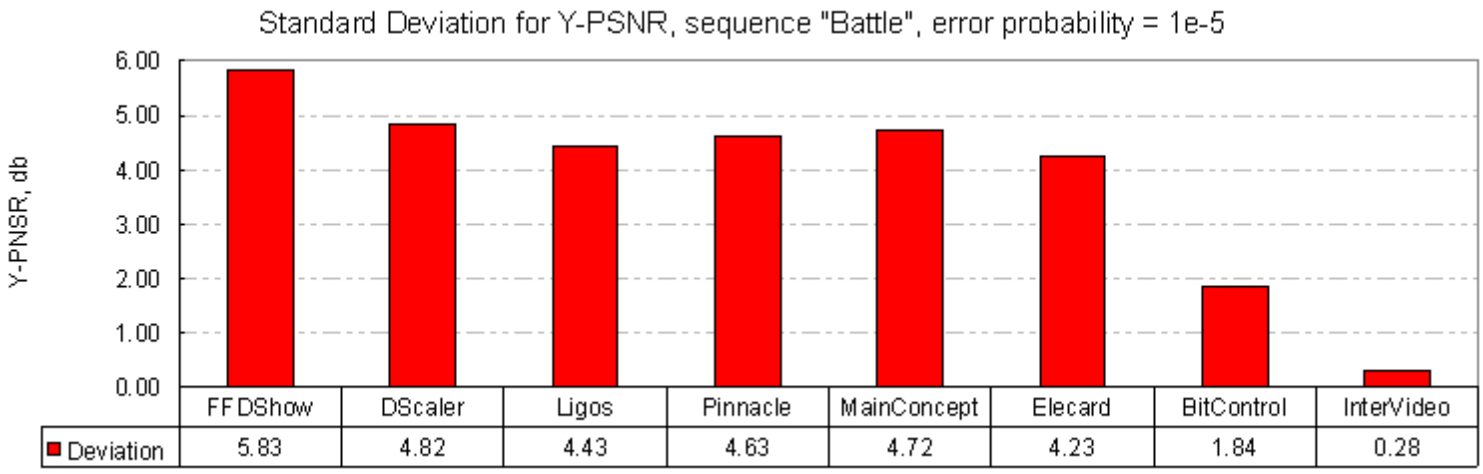
- For the averages: as in the previous paragraph.
- For the minimal values:
  - FFDShow, DScaler, Ligos and Elecard decoders give the best quality.
  - Pinnacle, MainConcept and Bitcontrol provide lower quality of decoded video.
  - InterVideo decoder failed to decode damaged stream.

According to the graph on Picture 25 decoders can be can be ranked as follows:

1. FFDshow
2. Ligos, MainConcept, Pinncale, Elecard and DScaler
3. BitControl
4. InterVideo

Standard Deviation

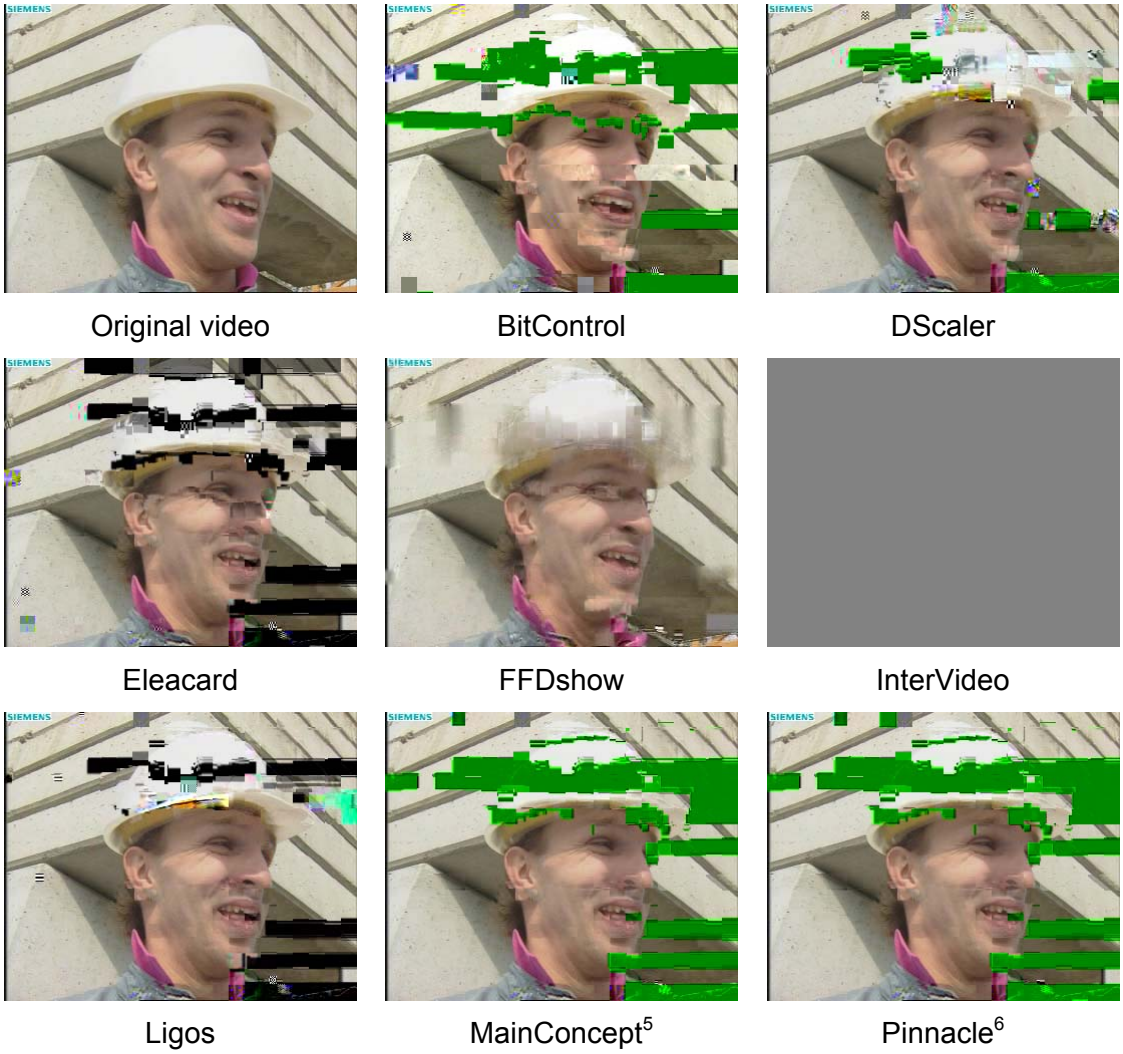
The conducted study showed that the higher average metric value, the higher is standard deviation generally.



Picture 29. Y-PSNR standard deviation, the "battle" sequence, error probability 10^{-5}

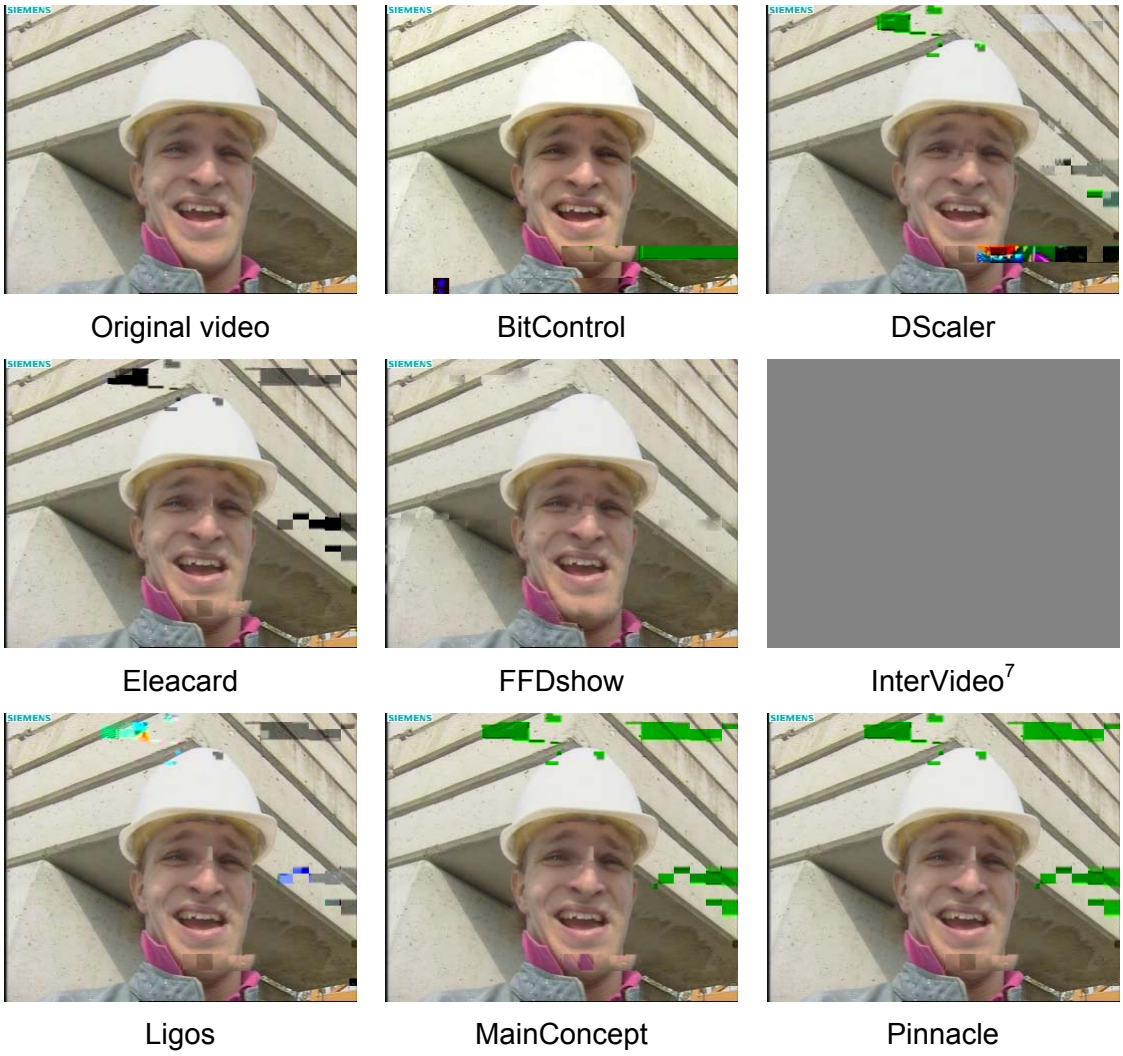
Visual Comparison

Besides using of objective metrics for analysis of decoded video quality, the visual study of decoded video was performed. This study helped to explain some results obtained while using objective metrics.



Picture 30. Visual comparison. The "Foreman" sequence, frame 10, error probability 10^{-4}

[5] The decoder failed to decode entire stream, stopped processing
[6] The decoder failed to decode entire stream, stopped processing



Picture 31. Visual comparison. The "Foreman" sequence, frame 17, error probability 10^{-5}

Conclusions:

- High quality of decoded streams for ffdshow decoder is explained by the fact that this decoder replaces damaged blocks by interpolations of neighboring blocks.
- Low quality of BitControl is due to a frames shifting in the decoded stream.
- InterVideo decoder failed to decode any frame of the sequence at the error probability 10^{-4}.
- MainConcept and Pinnacle decoders processed only a few first frames.
- Other decoders do not specifically process damaged frames, outputting them without changes.

[7] InterVideo decoder skipped almost all frames, only a few frames were decoded

General Conclusions

There is a common opinion that all codecs of a given standard do not differ from one another too much, all decoders work in the same way. The conducted research shows in a convincing way that it is not the case. In particular, decoders' developers implement in theirs products different schemes for processing damaged video streams. Some decoders are not supposed to work in situations of non-reliable data transmission channels, and quality of decoded video is very bad for them. The reason of differences among the decoders is that MPEG-2 standard offers some means for error recovery, but these means are not firmly specified by the standard.

Tested decoders could be divided into five classes.

1. *The first class* contains only one decoder – libavcodec from ffdshow. This decoder shows the best visual quality on corrupted video streams by diminishing noticeable visual artifacts by interpolation.
2. *The second class* consists of three decoders: Elecard, Ligos, and DScaler. These decoders could decode corrupted stream with few visual artifacts even with a very high bit error rate.
3. *The third class* contains two decoders: MainConcept and Pinnacle. These decoders could decode corrupted video stream with some visual artifacts which are not very noticeable. But these decoders could not decode stream with high error rate.
4. *The fourth class* includes only BitControl decoder – this decoder could decode corrupted video stream with visual artifacts, but it increases total brightness of the video (even without errors) and it can produce frame shifts while decoding corrupted streams.
5. *The fifth class* contains only InterVideo decoder – this decoder could not correctly decode corrupted stream even with low error rate, so it can not be used for such tasks.

Consequently, libavcodec from FFDshow is the best MPEG-2 decoder for providing good visual quality while working with corrupted streams.

Appendix A. Encoders Testing

The task was to test different MPEG-2 compliant encoders with the purpose of evaluating compressed video quality.

This testing does not pretend on fullness. It is intended only for analyzing situation with MPEG-2 encoders at the some cut.

Testing Rules

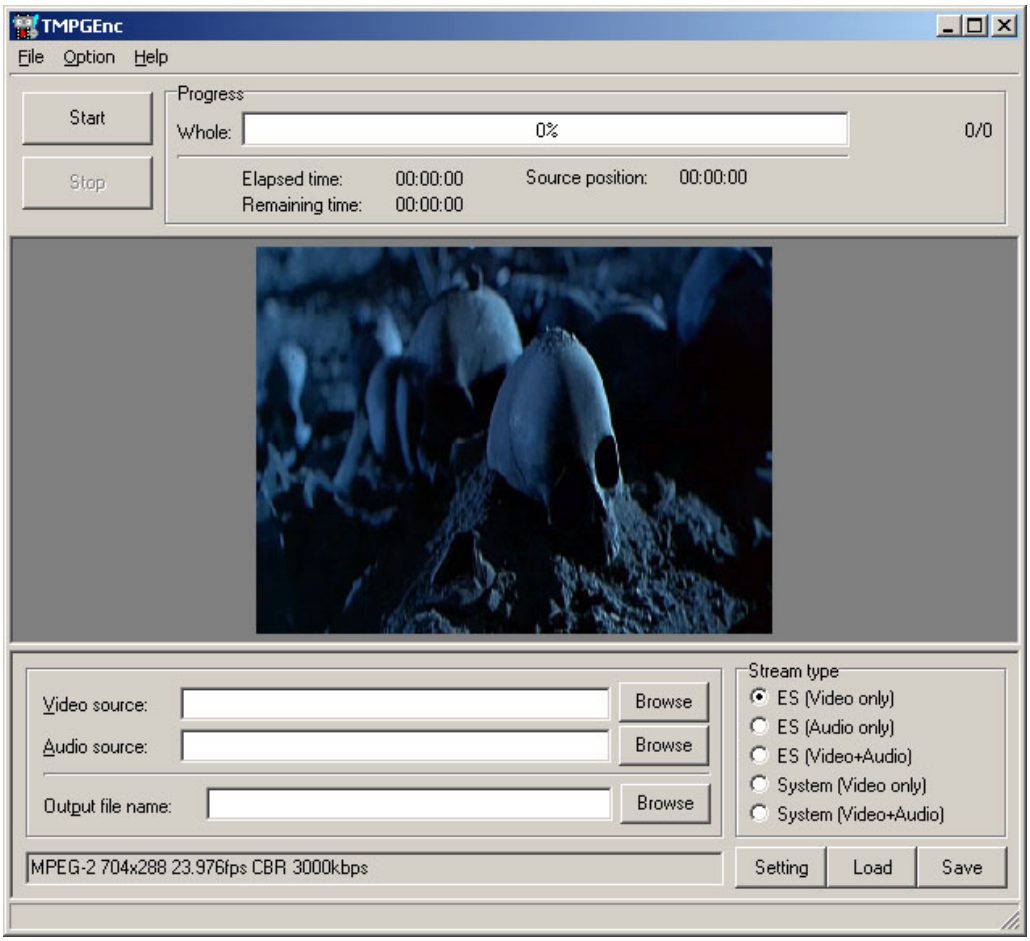
- The following 10 bitrates (Kbit/sec) were used during the testing: 100, 225, 340, 460, 700, 938, 1140, 1340, 1840, and 2340.
- The “Battle” video sequence with 1599 frames was used for testing.
- The following parameters were set for the encoders
  - bitrate;
  - video resolution;
  - frame rate;
  - GOP structure (group of pictures).
- Other parameters were set as default.

Encoders

Name	Developer	Version
1. Pinnacle MPEG 2 Encoder	Pinnacle Systems, Inc.	Pinnacle Studio 10.2
2. TMPGEnc	Pegasys Inc.	2.524.63.181
3. Intel MPEG-2 IPP	Intel Corporation	dev. version for 21.04.2006
4. Sorenson Squeezer	Sorenson Media, Inc.	4.3.302.4
5. MainConcept MPEG Encoder	MainConcept AG	1.05.00.00

TMPGEnc

- Encoder with GUI
- Version 2.524.63.181
- Great number of tuning parameters

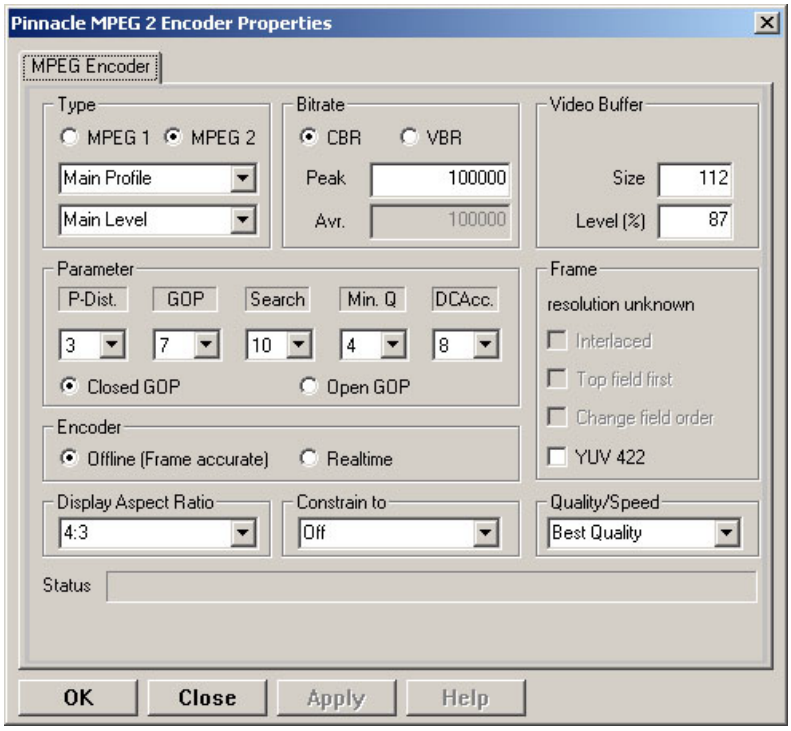


Picture 32. TMPGenc

Note: The encoder can not compress input stream encoded with HuffYUV.

Pinnacle

- DirectShow encoder
- Pinnacle Studio 10.2
- Great number of tuning parameters

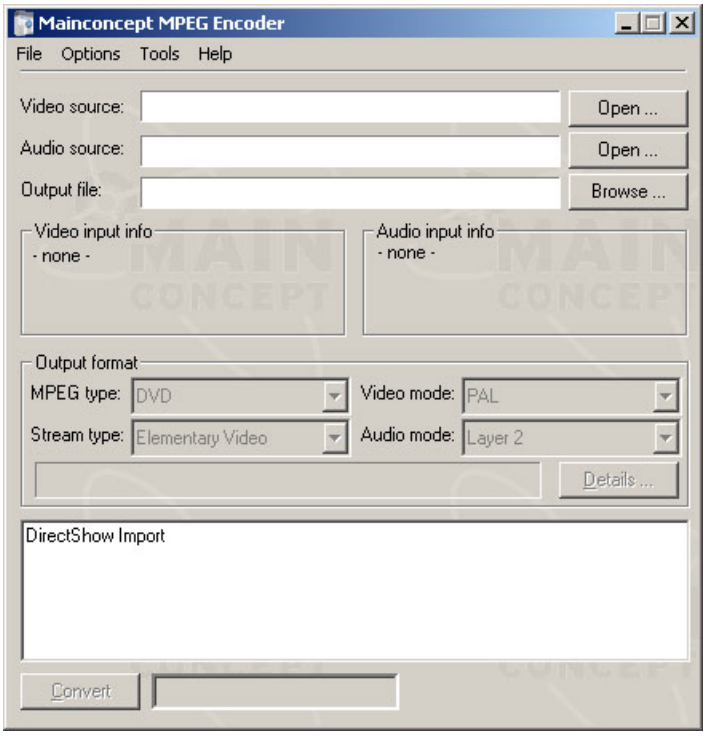


Picture 33. Pinnacle MPEG 2 Encoder

Note: The encoder performed all tasks without any problems.

MainConcept

- Encoder with GUI
- Version 1.05.00.00
- A quantity of tuning parameters

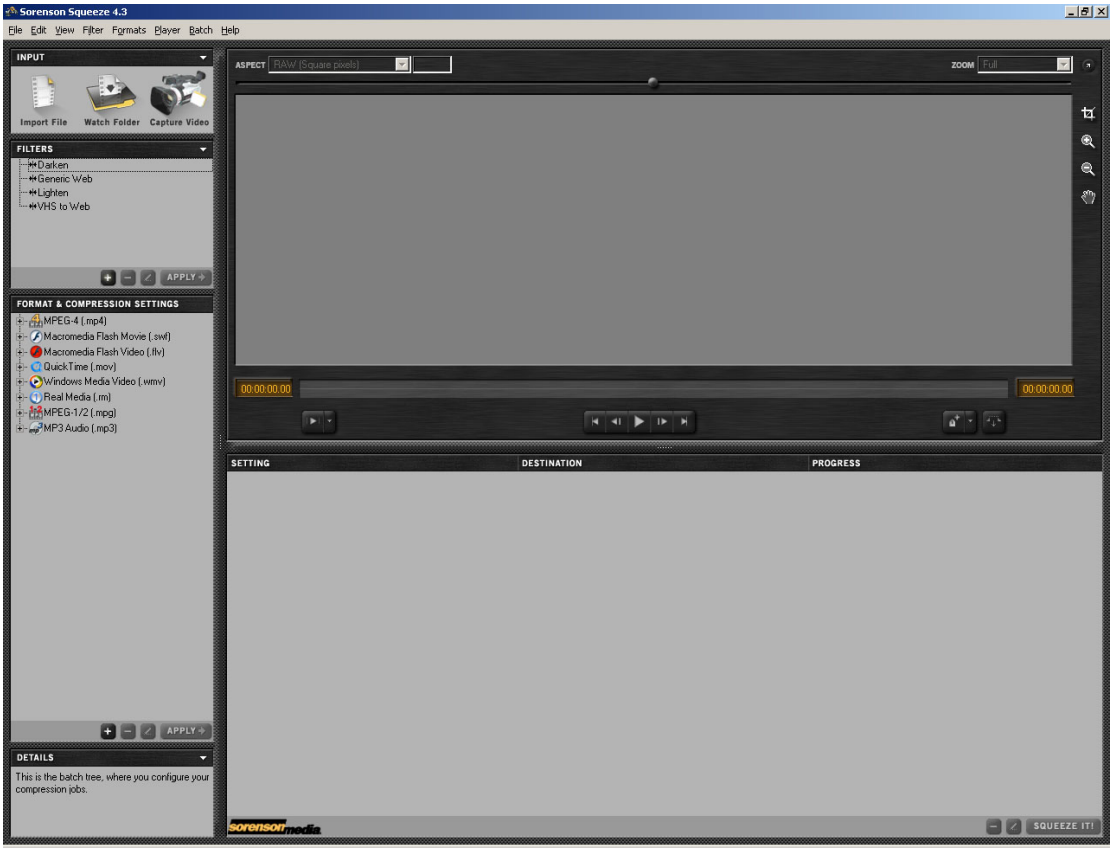


Picture 34. Mainconcept MPEG Encoder

Note: A big number of error messages were outputted while encoding with low bitrates.

Sorenson

- Encoder with GUI
- Sorenson Squeeze 4.3
- Multitude of tuning parameters



Picture 35. Sorenson Squeeze

Note: The encoder performed all tasks without any problems.

Intel

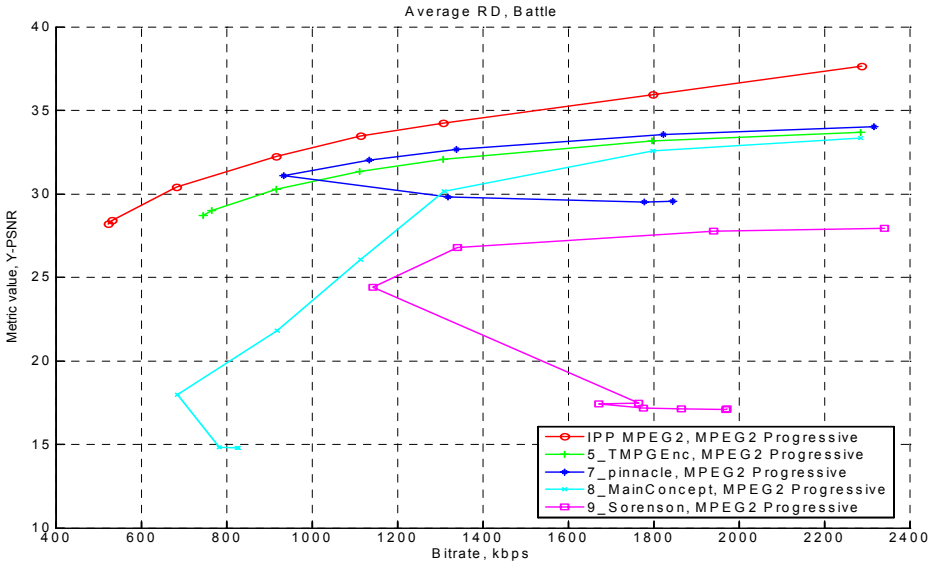
- Encoder with command-line interface from IPP
- Version was provided by the developers
- Great number of tuning parameters

Note: The encoder performed all tasks without any problems.

In next section there are compressed streams quality graphs for various metrics.

Y-PSNR

A some Y-PSNR/Bitrate graphs is presented below.

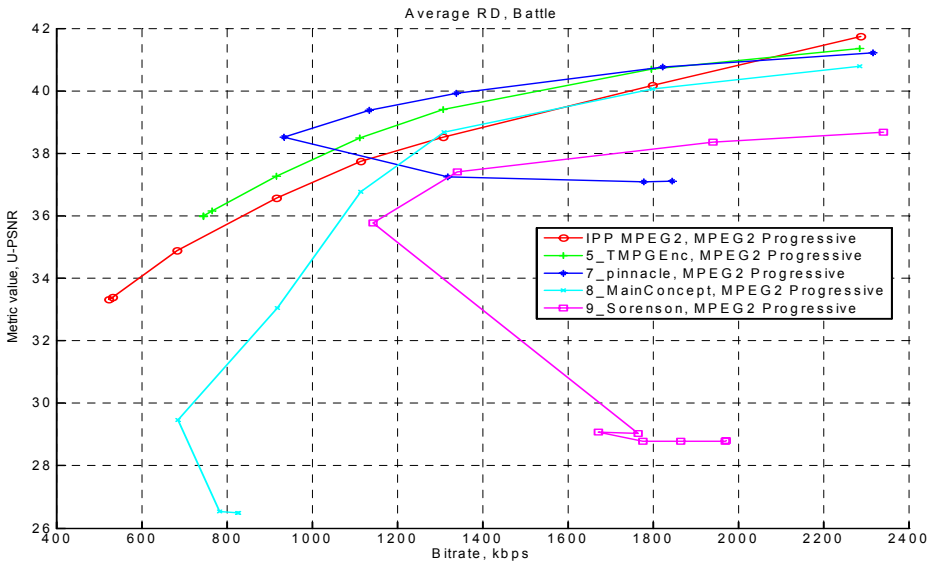


Picture 36. Y-PSNR. The "battle" sequence

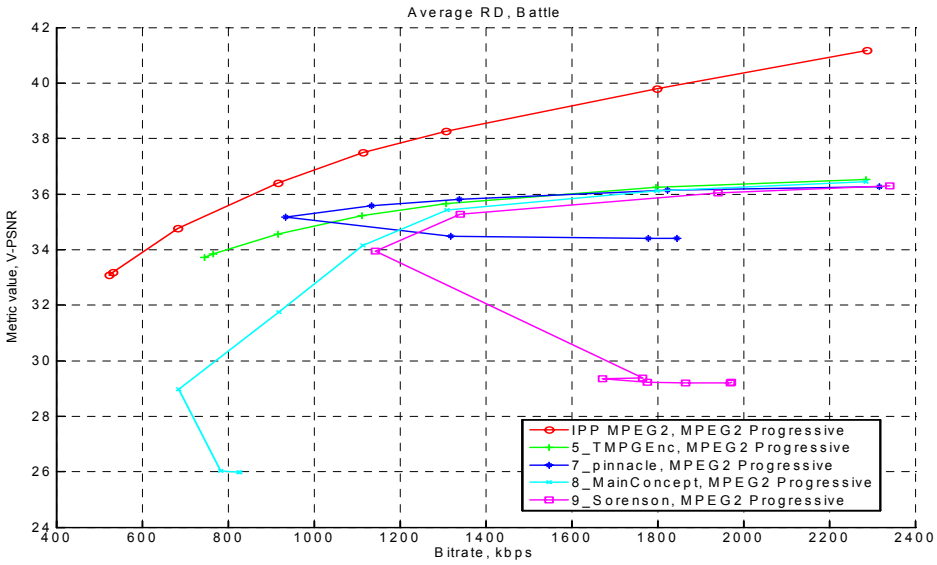
Conclusions:

- Intel MPEG-2 IPP and TMPGEnc encoders correctly work for different bitrates. Lower bitrates correspond to lower quality of compressed video and vice versa.
- Other encoders incorrectly work with low bitrates.
- The highest Y-PSNR value is obtained by Intel MPEG-2 IPP codec.

U-PSNR, V-PSNR



Picture 37. U-PSNR. The "battle" sequence

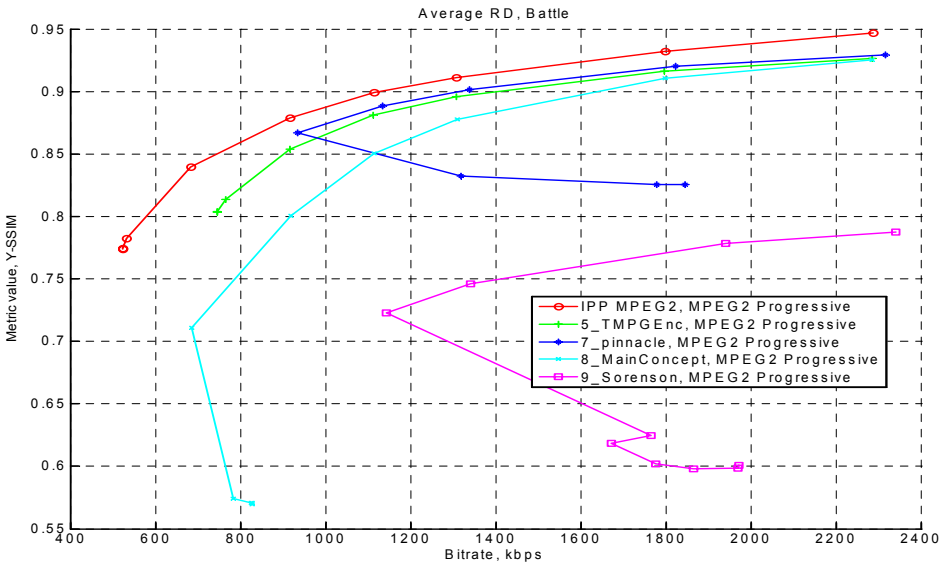


Picture 38. V-PSNR. The "battle" sequence

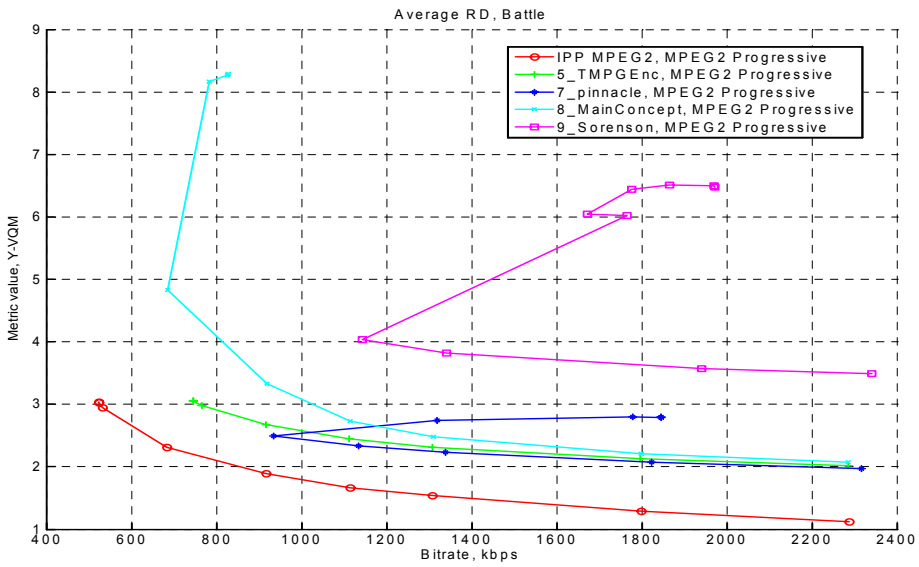
Conclusions:

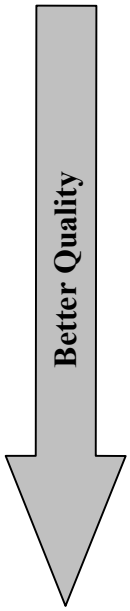
- Encoders process color planes (U and V) differently. The encoder that shows the best results at V-PSNR has a middle results at U-PSNR. The possible reason for it could be the different processing strategy for U and V components.
- Intel encoder's result by U-PSNR criterion is worse than many other encoders, while being noticeably ahead of others by V-PSNR metric.

SSIM, VQM



Picture 39. Y-SSIM measure. The "battle" sequence





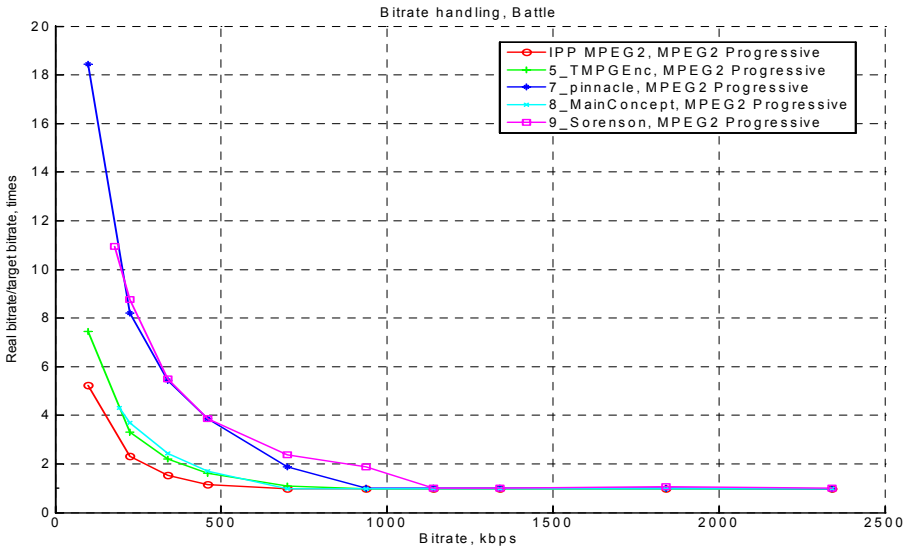
Picture 40. Y-VQM measure. The "battle" sequence

Conclusions:

- The results for Y-SSIM, Y-VQM and Y-PSNR metrics are similar.

Keeping of Desired Bitrate

Let us consider the graphs showing how precisely each codec kept the desired bitrate. The different bitrates are indicated by abscissa axis. The axis of ordinates is comparative surplus of bitrate for a given codec (the real to the desired bitrate ratio).



Picture 41. Bitrate handling. The "battle" sequence

Conclusions:

- Pinnacle encoder highly inflates low bitrates.
- All encoders raise bitrates below 500kbit/sec.
- High bitrates are kept by all encoders in generally the same way.

Conclusions

- The best quality among all tested encoders was showed by an encoder developed by Intel.
- The majority of MPEG-2 encoders cannot keep low bitrates.
- Some encoders may work differently with U and V color planes and that provides different efficiency.

If you are interested in your codecs' testing or tuning, please write to us at videocodec-testing@graphics.cs.msu.ru

About us (Graphics & Media Lab Video Group)

Graphics & Media Lab Video Group is a part of Graphics & Media Lab of Computer Science Department in Moscow State University. The history of Graphics Group began at the end of 1980's. Graphics & Media Lab was officially founded in 1998. Main research directions of the lab lie in different areas of Computer Graphics, Computer Vision and Media Processing (audio, image and video processing). Some of research results were patented, other results were presented in a number of publications.

Main research directions of Graphics & Media Lab Video Group are video processing (pre-, post- and video analysis filters) and video compression (codecs' testing and tuning, quality metrics research, development of codecs).

Our main achievements in **video processing:**

- High quality industrial filters for format conversion including high quality deinterlacing, high quality frame rate conversion, new fast practical super resolution, etc.
- Methods for modern TV-sets: big family of up-sampling methods, smart brightness and contrast control, smart sharpening, etc.
- Artifacts' removal methods: family of denoising methods, flicking removal, video stabilization with frame edges restoration, scratches, spots, drop-outs removal, etc.
- Specific methods like: subtitles removal, construction of panorama image from video, video to high quality photo, video watermarking, video segmentation, practical fast video deblur, etc.

Our main achievements in **video compression:**

- Well-known public comparisons of JPEG, JPEG-2000, MPEG-2 decoders, MPEG-4 and annual H.264 codec's testing; also we provide tests for "weak and strong points of codec X" for companies with bugreports and codec tuning recommendations.
- Our own video quality metrics research, public part is MSU Video Quality Measurement Tool and MSU Perceptual Video Quality Tool.
- We have internal research and contracts on modern video compression and publish our MSU Lossless Video Codec and MSU Screen Capture Video Codec – codecs with ones of the highest compression ratios.

We are really glad to work many years with companies like Intel, Samsung, RealNetworks and others.

A mutual collaboration in areas of video processing and video compression is always interesting for us.
E-mail: video@graphics.cs.msu.ru

MSU Video Quality Measurement Tool

MSU Graphics & Media Lab. Video Group.

GRAPHICS & MEDIA LAB VIDEO GROUP

Main Features

1. 12 Objective Metric + 5 Plugins

PSNR several versions,
MSAD,
Delta,
MSE,
SSIM Fast,
SSIM Precise,
VQM,
MSU Blurring Metric,
MSU Brightness Flicking Metric,
MSU Brightness Independent PSNR,
MSU Drop Frame Metric,
MSU Noise Estimation Metric,
MSU Scene Change Detector,
MSU Blocking Metric.

2. More Than 30 Supported Formats, Extended Color Depth Support

*.AVI,
*. YUV:
YUV,
YV12,
IYUV,
UYVY,
Y,
YUY2,
*.BMP,
*.AVS:
*.MOV,
*.VOB,
*.WMV,
*.MP4,
*.MPG,
*.MKV,
*.FLV,
etc.,

Extended Color Depth:
P010, P014,
P016, P210,
P214, P216,
P410, P414,
P416,
P410_RGB,
P414_RGB,
P416_RGB.

3. Multi-core Processors Support

MMX, SSE and OpenMP Optimizations

4. Comparative Analysis

Comparison of 3 files at a time

5. ROI Support

Metric calculation for ROI (Region of Interest)

6. GUI & Batch Processing

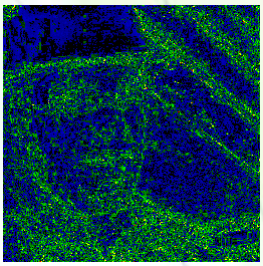
GUI and command line tools

7. Plugins Interface

You can easily develop your own metric

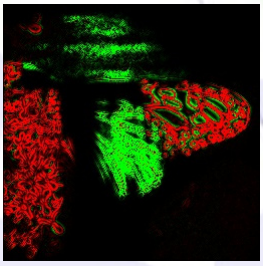
Visualization Examples

Allows easily detect where codec/filter fails

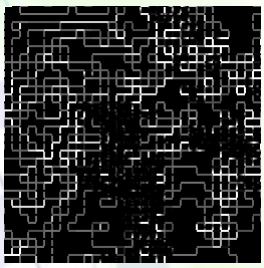


Y-YUV PSNR

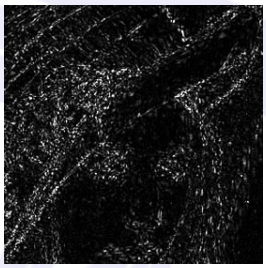
Y-YUV Delta



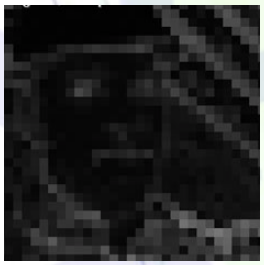
MSU Blurring Metric



MSU Blocking Metric



Y-YUV MSE



VQM

8. Universal Format of Results

Results are saved in *.csv files

9. HDTV Support

10. Open-Source Plugins Available

11. Metric Visualization

Fast problem analysis, see examples above.

http://www.compression.ru/video/quality_measure/index_en.html

Tool was downloaded more than 100 000 times!

Free and Professional versions are available

Big thanks to our contributors:

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